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Allis-Chalmers
Manufacturing Company
Mining Machinery Department

Bulletin No. 1445 **Superseding Bulletin No. 1506** **January, 1911**

Electric Hoists

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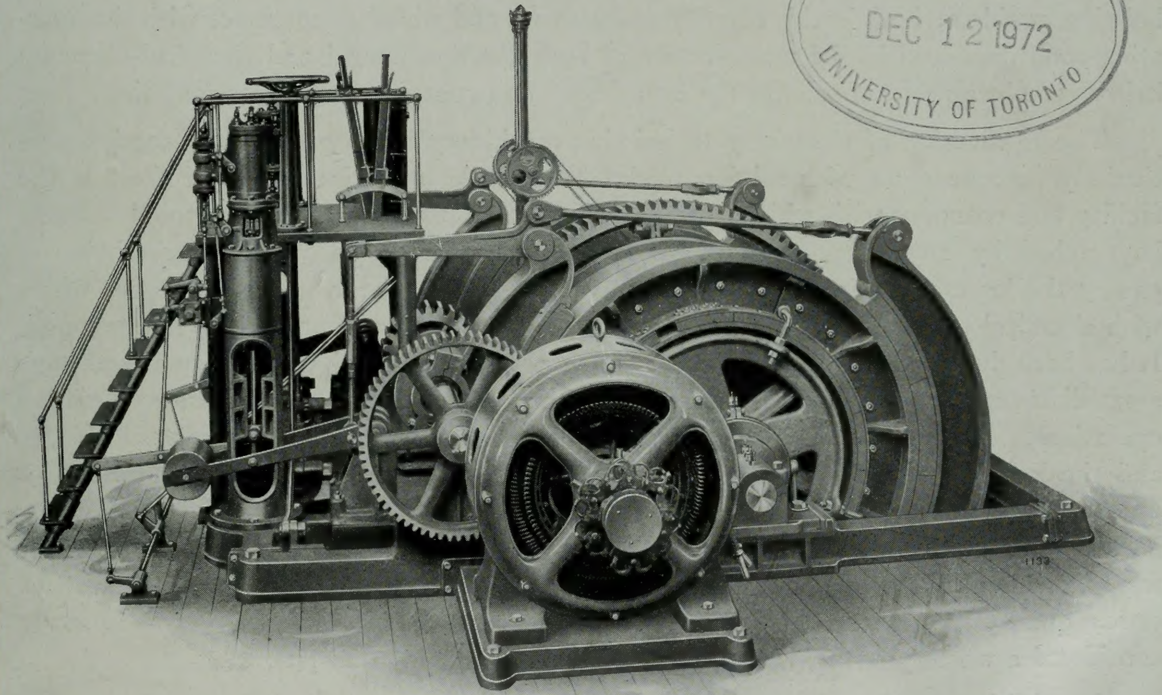

12,000 lb. Special Double Drum Electric Hoist, Equipped with Alternating Current Motor, Air Operated Post Brakes, Safety Overwind Device, Column Indicators and Hand Operated Clutches. Brake Engines Provi
Solenoid Operated Valves Which Will Apply
in Case of Failure of the Current Suppl

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ELECTRIC HOISTS

Having a wider experience than any other manufacturer in the successful design and operation of mining machinery, Allis-Chalmers Manufacturing Company has had an unusual opportunity to obtain a comprehensive knowledge of all the operating conditions to be met in hoisting engineering. It has been for years one of the leading builders of steam driven hoists, having installed them in all the principal mining districts in the world. Its hoists have proved commercially correct and thoroughly reliable in every respect. Being also one of the largest manufacturers of electrical apparatus its experience in this line has given it a thorough knowledge of the difficulties to be met and overcome in adapting electric power to the operation of hoists.

Allis-Chalmers Manufacturing Company has made an exhaustive study of the electric hoisting problem, both in this country and abroad, and with its experience with the operating conditions and in the manufacture of both the mechanical and electrical elements it is placed in a position to offer the best design and construction in electric hoists.

The application of electricity to hoisting machinery has a great many merits, particularly in connection with mining work. One of the most important of these is the facility and economy with which power can be transmitted to places that could scarcely be reached by any other method. In using hydraulic or pneumatic transmission of energy the losses are unusually high due to unavoidable pipe losses and leakages while, with electrical transmission, the losses, even for great distances, are only a few per cent. It has been due to this facility of transmitting power with so slight a loss and over such great distances that has brought about the extensive application of electricity to mining operations. A comparatively long transmission system presents no particular difficulties and the location of the central generating station can therefore be determined not so much with reference to the point at which the energy is to be used but rather as to where it can be most economically generated. This makes it possible to develop water powers for generating electric current, to utilize blast furnace gases, refuse from coke ovens, or low quality fuels from coal mines. One of these sources of power which was formerly considered a waste product, is available in nearly all mining districts.

In addition to the advantage of utilizing waste products for power purposes, the electric central station and the attendant centralization of the loads makes the engine load more constant and provides a means of securing the most favorable possible steam consumption. Where hoisting must be done underground, the electric hoist has no equal. Power can be transmitted very easily through the mine for operating the hoist and other machinery. The transmission system requires practically no space and the lines can be deflected in any direction without causing loss in energy. Electrical transmission furnishes a method of supplying power for any purpose, at widely separated points.

GENERAL SPECIFICATIONS

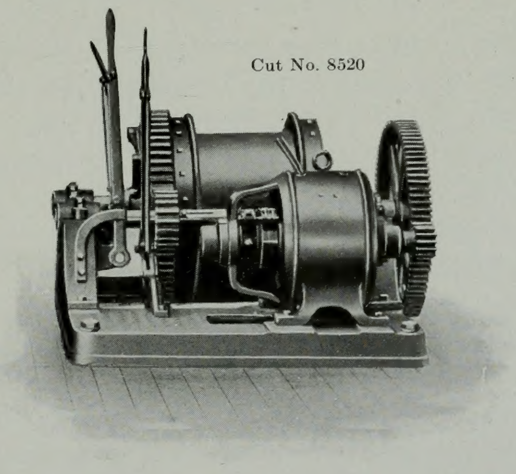
MECHANICAL FEATURES.

BED PLATE:

The bed plate of Allis-Chalmers hoists is made of the best quality of cast iron and is of the hollow box section type. This type of construction allows moderate weight and a distribution of metal which affords ample strength to withstand all shocks and strains to which a hoist is subjected when in use. The smallest single drum 2000 lb. rope pull hoist has the bed plate cast in one piece. In this unit the two bearings on each side are cast in one piece and bolted to the bed plate. From this smallest unit to the 8000 lb. rope pull hoist inclusive, the bed plates are made in sections having high end sections with the bearings cast as a part of them. These end sections are connected together by side distance pieces. The 9000 lb. to 20,000 lb. rope pull units have the bed plates also made in sections of the hollow box section type and the entire frames are made as low as is consistent with the necessary strength, and are provided with planed pads to which the bearing pedestals are bolted. The pedestals are held in place laterally by means of wedges. The joints of the sections of the bed plates are carefully machined and bolted together. All but Allis-Chalmers Manufacturing Company's smallest single drum hoists are provided with an extension for the motor, which extension is of the same general design as the main bed plate. The main bed plate and extension are carefully machined at the joint and bolted together.

DRUMS:

The drums of all Allis-Chalmers hoists are made of high quality cast iron, and up to and including the 8000 lb. units they are cast in one piece having the brake-wheel and clutch ring cast as part of the drum shell. 9000 and 12,000 lb. rope pull hoists have the drum shell cast as part of one of the spiders and have a carefully machined drum flange at the other end. The flanged end is bolted to and supported by a heavy combined spider, clutch ring and brake wheel cast as one piece. The drum of the 15,000 lb. and 20,000 lb. rope pull hoists consists of the drum shell cast as one piece and provided at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2000 Lb. Standard Single Drum Electric Hoist, with Direct Current Motor both ends with flanges, carefully machined. One end of the shell is bolted to and supported by a heavy cast iron end spider. The other end of the shell is bolted to and supported by a spider which also carries the brake wheel and clutch ring, all cast in one piece.

The surface of a standard drum shell is made smooth and a shell grooved for the rope can be furnished at an additional cost. The shell is reinforced where necessary, by means of deep circular ribs on the inside. The drum spiders are fitted with machined bronze bushings so that the drum can run loose on the shaft. The bushings are held to the spider hubs by means of tap bolts and arranged so that they can be easily removed for replacement when worn. The hole in the shell through which the rope passes for fastening has a long radius curve in order to prevent any possibility of breakage of the rope at this point.

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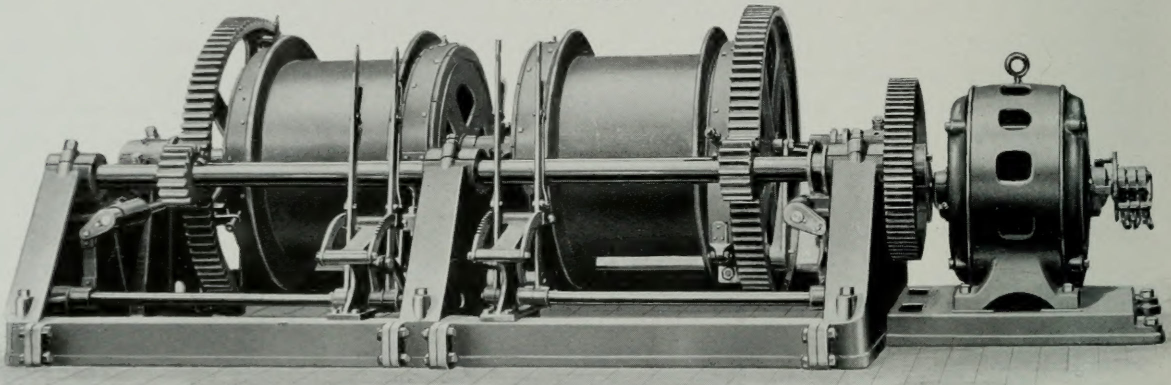

3500 Lb. Standard Double Drum Electric Hoist with Variable Speed Induction Motor

CLUTCH:

The clutch used on these hoists is of the modified Lane friction type. On the 8000 lb. rope-pull and smaller hoists, the main gear constitutes the driving member of the clutch which is keyed to the drum shaft. The gripping member comprises a steel band encircling the clutch ring which is mentioned under the heading "Drums". This band is lined with removable basswood blocks secured to the band by means of countersunk carriage bolts. One end of the band is securely anchored to the gear and provided with adjustment for shortening the band in order to take up for the wear of the blocks. The movable end of the band is actuated by a simple, though powerful, arrangement of a toggle lever. This lever is connected to the clutch sleeve which slides on the drum shaft. The sleeve is actuated by the operator's clutch lever through suitable connections. When the clutch is disengaged, the band is entirely free from the clutch ring. The clutch is self-locking whether it is thrown in or out. The operating lever is provided with a latch and notched quadrant.

On the larger sizes, lifters are provided to support the band when disengaged.

In hoists of sizes above 8000 lbs. rope pull, the clutch used is of the Allis-Chalmers improved Lane friction type. This consists of a cast steel spider keyed to the drum shaft. The fixed and movable arms of the clutch are also of steel and are fastened to the disc. The other details and operation of this type of clutch are the same as above.

Allis-Chalmers Manufacturing Company is also prepared to furnish, for the operation of the larger clutches, auxiliary air engines, controlled by the operator's lever.

BRAKE:

Allis-Chlamers hoists are equipped with either the band or post type of brake, depending on the size of hoist or customer's preference.

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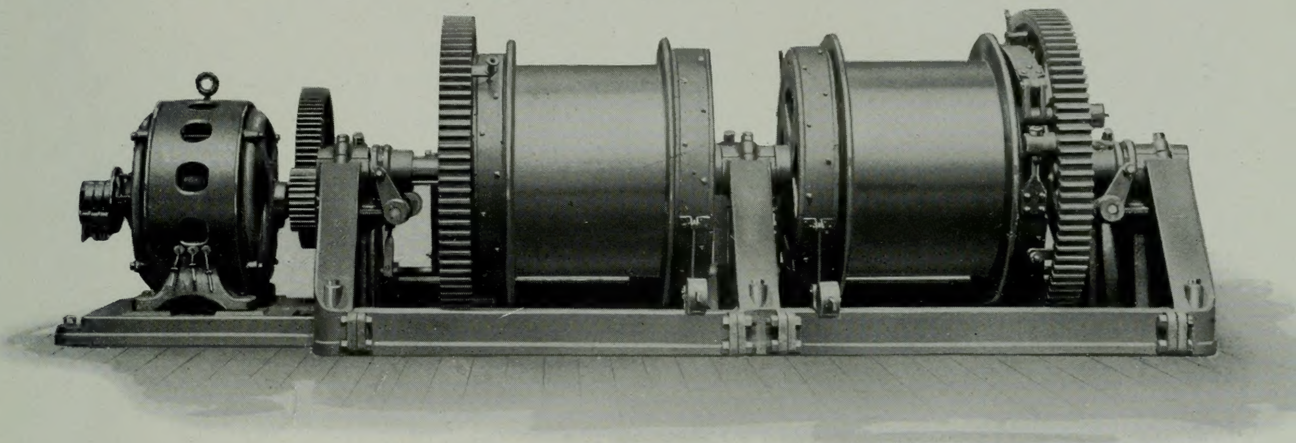

3500 Lb. Standard Double Drum Electric Hoist, Equipped with Variable Speed Induction Motor—Rear View

The band type of brake consists of a steel band, lined with removable basswood blocks which are of ample width to prevent over-heating. The band is provided with a turn buckle adjustment for taking up the wear of the blocks. One end of the band is securely anchored around the operating shaft and the other end is connected to the operator's lever. On the larger hoists the brake bands are provided with counter-weights which cause the band to entirely clear the brake wheel when released.

The post type consists of two vertical beams fitted with basswood blocks, encircling the brake wheel on opposite sides. The lower end of each post is hinged to a massive fulcrum bracket which is securely bolted to a sole plate which is bolted to the foundation. Adjustment is provided to take up the wear of the blocks. Parallel motion post brakes can be furnished where desired.

Accordingly, as conditions may demand or as a customer may prefer, the brake is designed to be operated and controlled either by means of a hand lever, hand wheel or by an auxiliary air cylinder controlled by the operator. In case the lever is used it is provided with notched quadrant and latch.

When the brake is to be controlled by means of an auxiliary air cylinder it will be set by a weight and held released by the air. Tandem with the air cylinder, an oil cataract cylinder and floating lever device is provided so that any amount of braking can be applied and fully controlled. Having the weight set the brake, and the air cylinder release it, provides an automatic means of setting the brake in case of failure of the air supply.

In special cases both a hand wheel and an air cylinder to operate the same brake can be provided; each operating entirely independent of the other so that the hand wheel can be used as an emergency in case the air cylinder is disabled.

With an air operated brake there can also be provided an auxiliary valve on the cylinders, operating by a weight held up by an electric solenoid in such a manner that the weight will drop and open the valve, thereby releasing the air pressure and setting the brake automatically, if for any reason the line current which energizes the solenoid, should fail. This system is also used in a safety overwinding device in which a specially designed switch, operated in conjunction with the indicator, is placed in series with a no-voltage coil on the main circuit breaker, so that in case of overwinding a special switch will trip the circuit breaker, cutting off current both from the hoist motor and from the solenoid above referred to, bringing the host to an immediate stop.

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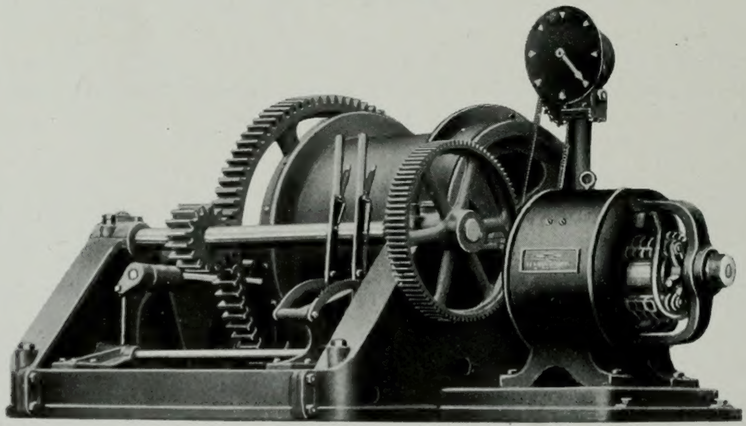

5000 Lb. Standard Single Drum Electric Hoist with Direct Current Motor and Dial Type Indicator

An auxiliary emergency solenoid operated brake can also be furnished on the motor shaft, arranged to be set by a weight and held released by a solenoid so that it will automatically set in case of failure of current supply while hoisting. For exceptionally long inclinations where the loads are lowered by means of the brakes, the drum can be equipped with two brakes so that the operator can change from one to the other as they tend to heat up. In this case the brake blocks can also be made of asbestos consisting of several thicknesses of asbestos board on edge held together by steel side plates. These asbestos blocks are treated with a mixture of linseed oil and plumbago.

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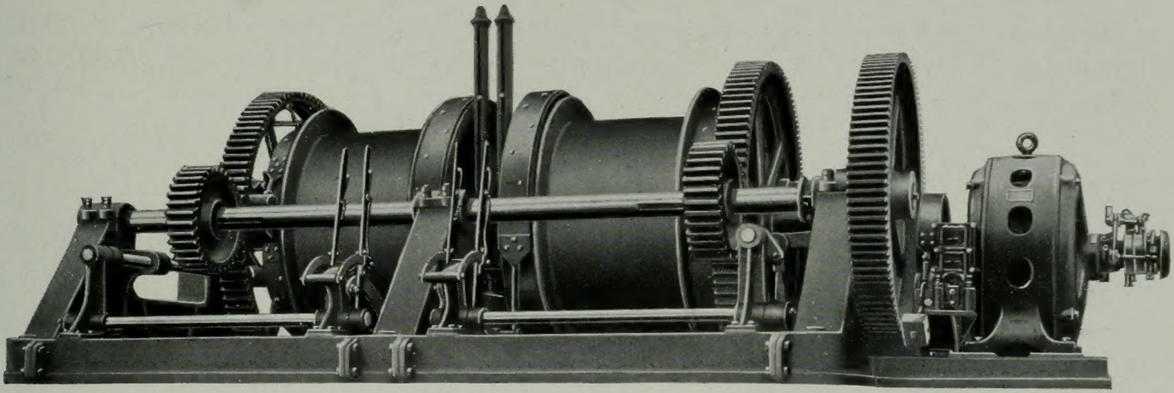

7000 Lb. Standard Double Drum Electric Hoist, Equipped with Variable Speed Induction Motor and with Column Indicators and an Emergency Solenoid Operated Brake on the Motor Shaft

BEARINGS:

The bearings of units smaller than 9000 lb. rope pull are cast as a part of the end sections of the hoist, as noted under the heading "Bed Plates". All bearings are lined with the best quality of babbitt metal and are provided with oil grooves designed to effect an even distribution of the lubricant. The bearing pressure per square inch is kept exceedingly low so that the bearings under the most severe duty will run cool. On the larger hoists the bearings are of Allis-Chalmers Manufacturing Company's standard low back, rigid type carefully machined at the base and securely bolted to machined pads on the bed pate. Where it is necessary, an outboard bearing will be used to support the extension of the motor shaft which carries the motor pinion. This bearing will be of the collar oiling type bolted to the bed plate. The hoist bearings and the drums are supplied with grease cups of ample capacity.

SHAFTS:

The shafts are made of the best quality of open hearth steel accurately turned and keyseated where necessary. They are made extra large to withstand the severe strains to which they are subjected.

GEARS AND PINIONS:

Allis-Chalmers Manufacturing Company's gears are made of a special mixture of tough cast iron. They are made with extra heavy rims, arms and hubs, with face and pitch very liberal for the particular duty of the gears.

The pinions are made of cast steel and are equally as liberal in design as the gears.

The teeth of both gears and pinions are machine cut from a solid blank by means of one of the latest designed automatic gear cutters. The tooth cut is of a short involute form and the cutters used produce a gearing as perfect as the present height of mechanical development permits.

FOUNDATION BOLTS AND WASHERS:

Foundation bolts and washers are not included with the hoists unless specified. If desired, they will be furnished as an extra.

ROPE AND WIRING:

The hoisting rope and necessary wiring between motor and controlling equipment are not included with the hoist.

MATERIAL AND WORKMANSHIP:

Material is strictly first class in kinds and qualities suitable for the various purposes, and free from injurious or unsightly blemishes.

The workmanship is strictly first class throughout.

PAINTING:

All unfinished parts of the hoists are painted with one coat of shop paint before shipping.

PACKING FOR SHIPMENT:

The hoist is prepared in a manner customary for domestic rail shipment. Packing for foreign or coastwise shipment will be made at an additional charge.

INDICATORS:

Indicators are not included with the hoist unless specified and are considered an extra.

Allis-Chalmers Manufacturing Company can furnish either the column or dial type of indicator. The standard column type consists of a suitable pipe column mounted on a stand. Inside of the column a vertical screw is operated by means of bevel gears. On the screw is attached a pointer working in a slot in the column.

The dial type consists of a large dial having a movable pointer driven by a worm and wheel. Both the column and dial type of indicator are driven from the end of the drum by means of cut teeth, sprockets and chains.

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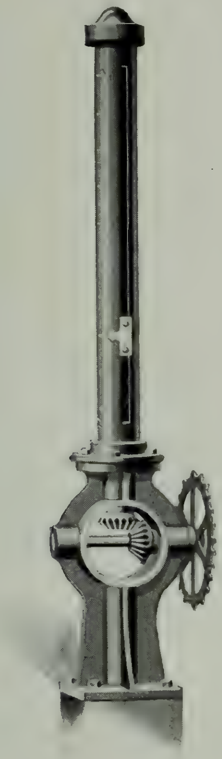

Column Type

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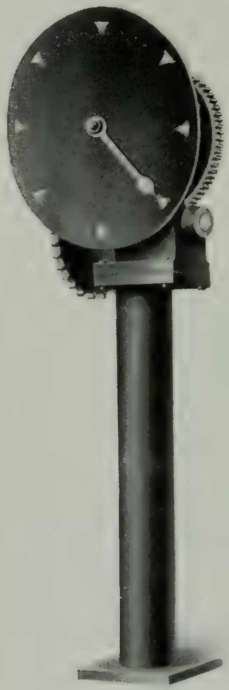

Dial Type—Front View

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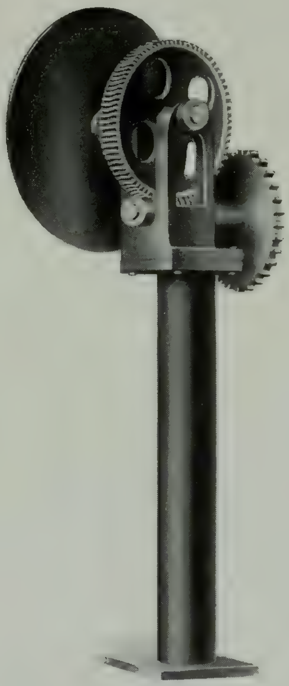

Dial Type—Rear View

ELECTRICAL FEATURES

MOTORS

Allis-Chalmers electric hoists are equipped with either direct current or alternating current motors. This company builds an extensive line of both direct current and alternating current motors, and as it guarantees the successful operation of the entire unit it will select the motor best suited for the particular conditions.

On account of the large starting torque required, series wound motors are generally used on direct current circuits. Allis-Chalmers type "K" motors used for this service are very compact, the construction is rigid and every detail perfected with special reference to the most exacting requirement of modern service.

DIRECT CURRENT MOTOR SPECIFICATIONS.

FRAME:

The cylindrical field magnet yoke is of open hearth steel and machined on each end to receive the housings that carry the bearings. The yoke is machined on the inside of the cylindrical surface and the poles are fastened to it by filister head cap screws.

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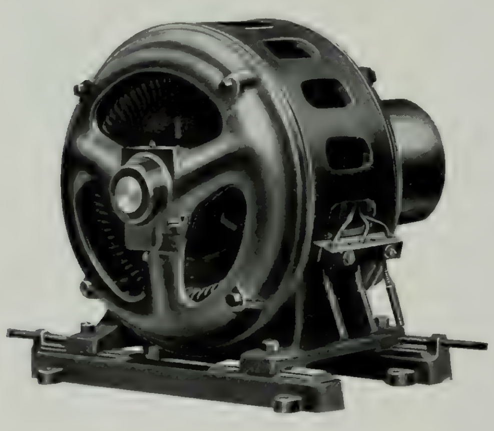

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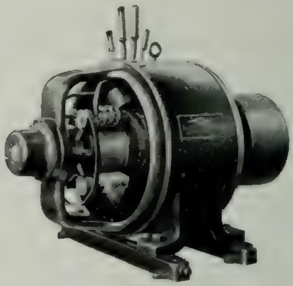

Pole cores are of open hearth steel and are circular in cross-section; these cores are machined on one end to fit the under surface of the cylindrical yoke and on the other to receive the pole shoes. The latter are built up of annealed steel punchings riveted together and fastened to the poles by flat head machine screws. The field coils are thoroughly impregnated to secure effective insulation and protection from moisture.

ARMATURE:

The armature cores are built up of sheet punchings insulated from each other to reduce the core loss and consequent heating. The laminations are keyed to the shaft, and in building up the core they are separated at intervals to form radial ventilating ducts. The punchings are firmly clamped between cast iron end heads, which also serve as supports for the ends of the armature coils. In punching the armature laminations, openings are made in the discs, so that when the latter are assembled, ventilating passages are formed parallel to the shaft and connecting with the radial ducts. There is thus a free passage for circulation of air through the core, and all parts of the core and windings are thoroughly ventilated.

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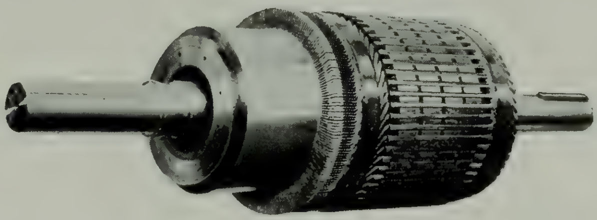

The armature coils are form wound and interchangeable; they are heavily insulated with stay binding and the whole armature is thoroughly impregnated with insulating varnish after it has been completely wound.

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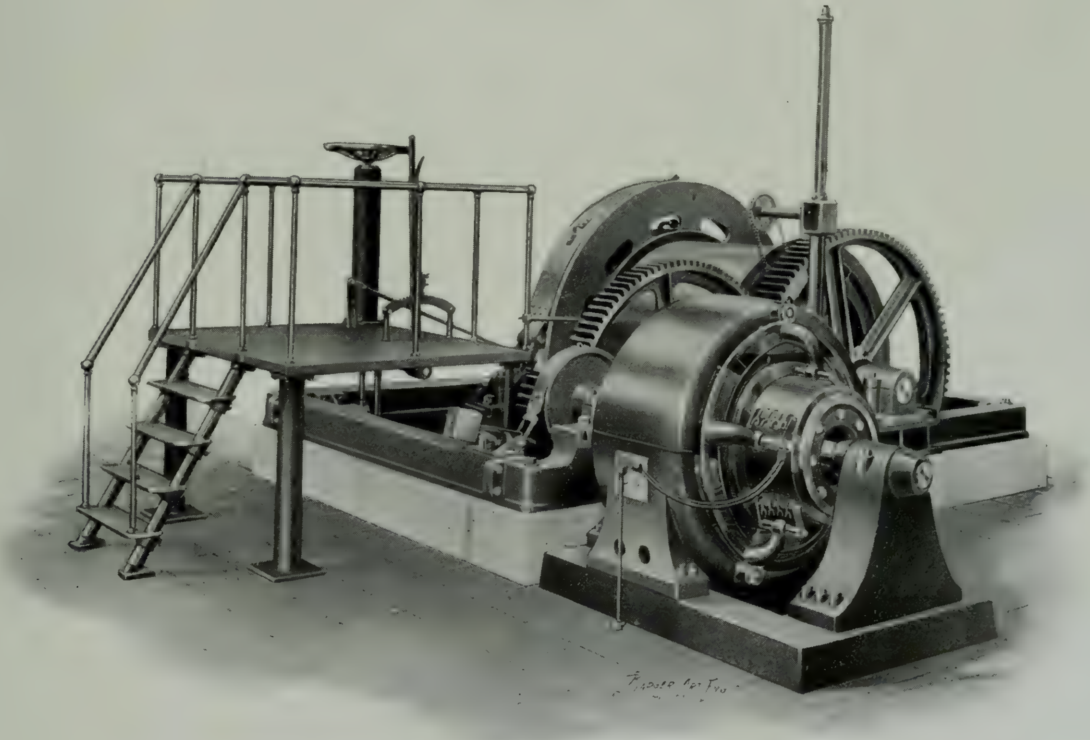
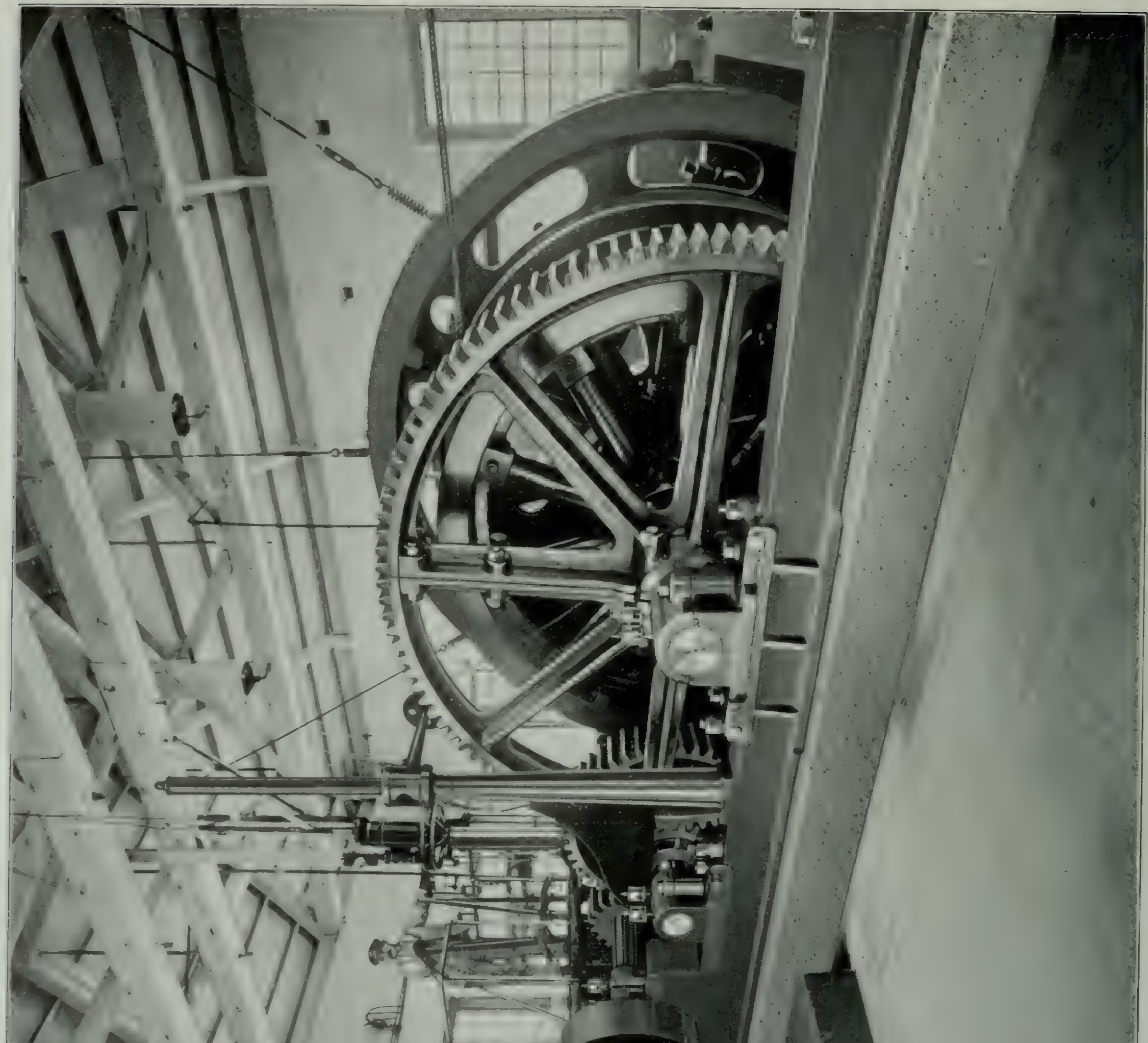


12,000 Lb. Special Single Drum Electric Hoist with Direct Current Motor. Column Indicator and Safety Emergency Solenoid Operated Band Brake



25000 Lb., Special Single Drum Electric Hoist Equipped with Variable Speed Induction Motor, Column Indicator, Air Operated Brake and Clutch, Auxiliary Arrangement for Emergency Operation of Brake and Clutch by Hand. Brake Engine Provided with Auxiliary Solenoid Operated Valve Which Will Apply the Brake in Case of Failure of the Current Supply.

The commutator is of large diameter and ample wearing depth, having bars of hard drawn copper insulated from each other and from the shell by the best quality of mica; the mica between bars is selected so as to give even wear. The clamping rings hold the bars very firmly, and the whole construction is such as to secure a perfect cylindrical surface, free from high or low bars. The commutator sleeve, in all except the smaller sizes, is cored to permit the passage of air through to the armature.

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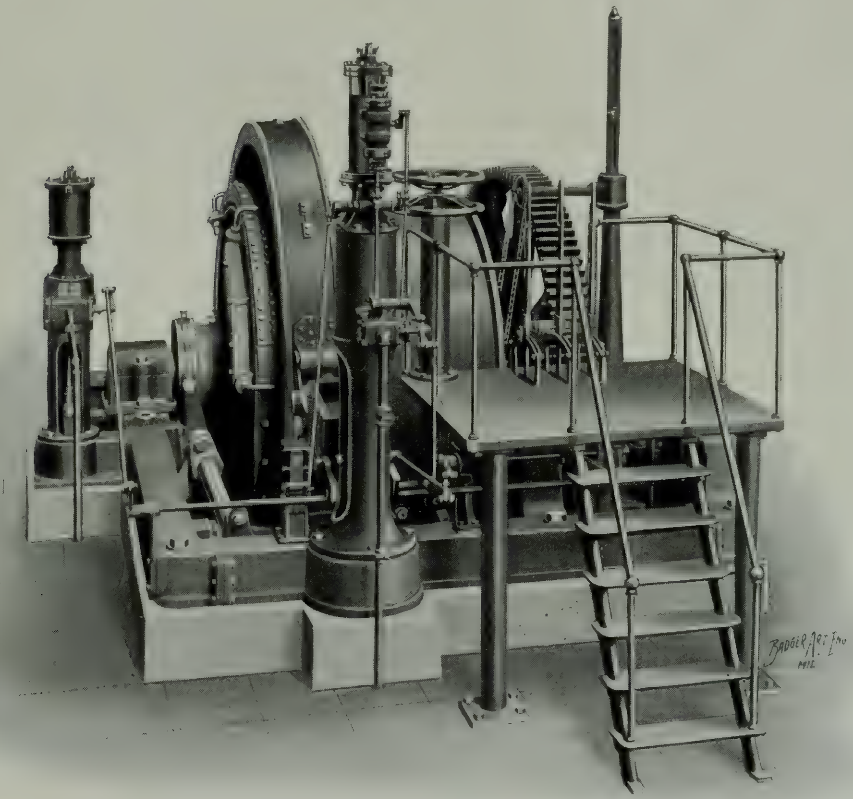

25,000 Lb. Special Single Drum Electric Hoist. Same Hoist as Shown on Page 12 but Showing View from Other Side and the Motor Removed

BRUSH HOLDERS:

The brush holders are of the reaction type of the same general design as used on all Allis-Chalmers standard direct current machines. They are simple in construction, positive in action, and allow the brush to follow the surface of the commutator freely.

ALTERNATING CURRENT MOTOR SPECIFICATIONS

For alternating current, induction motors of the wound rotor type are used. The rotor of this type has a polyphase winding connected to collector rings in order to insert an external resistance in the circuit for speed regulation. These motors will start under all loads for which the hoist is designed, are easily controlled and substantial in construction.

STATOR:

The stator core is built up of punchings carefully annealed and varnished to reduce the core loss; when assembled these punchings form a core having slots in its inner periphery. The coils are wound on forms and carefully insulated and impregnated with insulating compound before being placed in the slots. The coils are placed in open slots and thus easily removable. Before being placed in the open slots the straight portions of the coils are pressed to gauge so that they fit the slots exactly. The ends of the coils where they project beyond the core are well protected by the stator yoke and end housings. The yoke has numerous openings to provide ventilation and is made heavy enough to form a firm support for the punchings.

ROTOR:

The rotor punchings are mounted on a cast iron spider having arms shaped to act as fan blades, and thus force air through the motor.

The rotor core is built up of steel laminations in a manner similar to the stator core. The rotor has a polyphase winding connected to collector rings so that an external resistance can be inserted.

CONTROLLERS

DRUM TYPE:

The controllers are generally of the reversible drum type, both for direct current and alternating current motors. The resistance is mounted separately in convenient frames.

SOLENOID TYPE:

For a motor of large capacity it is not feasible to use a drum type controller and in this case a controller of the solenoid operated type can be employed. This type is mounted in switchboard form and is controlled by a master drum at the hoist. The resistance is furnished mounted separately in a convenient form. A solenoid type of controller can be either manually operated, in which case the operator controls the rate of acceleration, or it can be provided with relays to give a uniform automatic acceleration. In the latter case if the operator turns the handle of the master drum at once to full running position, the relays uniformly accelerate the load in predetermined time. It is impossible for the operator in this case to accelerate the load in less time than that for which the relays are set but on the other hand he can accelerate at a slower rate and longer time.

This company does not mount the drum of the controller on the hoist but ships it separately so that it can be located at the hoist in a way most convenient for the operator.

LIQUID RHEOSTAT TYPE:

For large alternating current motors, Allis-Chalmers Manufacturing Company has supplied controllers of the water rheostat type. This type of control possesses many advantages. It permits the omission of all electrically operated contactors with their inherent maintenance difficulties. It also permits an absolutely smooth acceleration which is impossible to obtain with the step by step method. With this type of controller any speed from creeping to full speed can be easily maintained.

When used with an induction motor this type controls the speed of the motor by varying the area of the electrodes immersed in the electrolite.

The controller equipment consists of the necessary primary reversing oil switches together with the rheostat proper and the necessary operating mechanisms.

The rheostat proper consists of a suitable tank in which are placed the electrodes of such a size as to keep the current density per square inch as low as possible. These electrodes are connected to the slip ring of the motor.

This type of controller can also be designed for direct current motors.

Allis-Chalmers Manufacturing Company studies the requirements of the service for which each machine is intended and makes provisions accordingly. Inquiries for proposals on electric hoists should, therefore, give the following information in detail.

Location
Geared or first motion
Single or double drum

Load
- Weight of skip
- " " cage
- " " car
- " " ore
- " " rope

Average speed desired
Shaft—Vertical or inclined
- Degree of inclination from horizontal
- Single or double compartment
- Size of compartments
- Present depth
- Ultimate depth

Size and kinds of rope to be used dia. strands wires
Cages—In balance or independent
If in balance, will the hoist ever be called to operate unbalanced, if so, for how long at a time and will it be necessary to handle the full load

Type of clutch desired
Type of brake desired
Electric Current available at motor-alternating or direct
- Voltage
- Phase
- Cycle
- Time in operation
- Time at rest
- Time of stop between hoists

Remarks

ON the following pages are given outline diagrams of both single and double drum hoists of standard designs which show the general plan of these hoists. Tables are also included giving data on the various hoists and approximate overall dimensions. Further information as well as information on special hoists, will be gladly furnished upon application.

Note that the smallest single drum unit has the motor mounted as shown in the illustration on page 3 of this bulletin, instead of to the side as shown by the diagram. The ratings given in the tables are the standard ratings for the particular units. These units can be arranged, where conditions require it, for special rope speeds between certain limits and information in regard to these special rope speeds will be furnished upon request.

STANDARD SINGLE DRUM ELECTRIC HOISTS

HIGH FRAME TYPE

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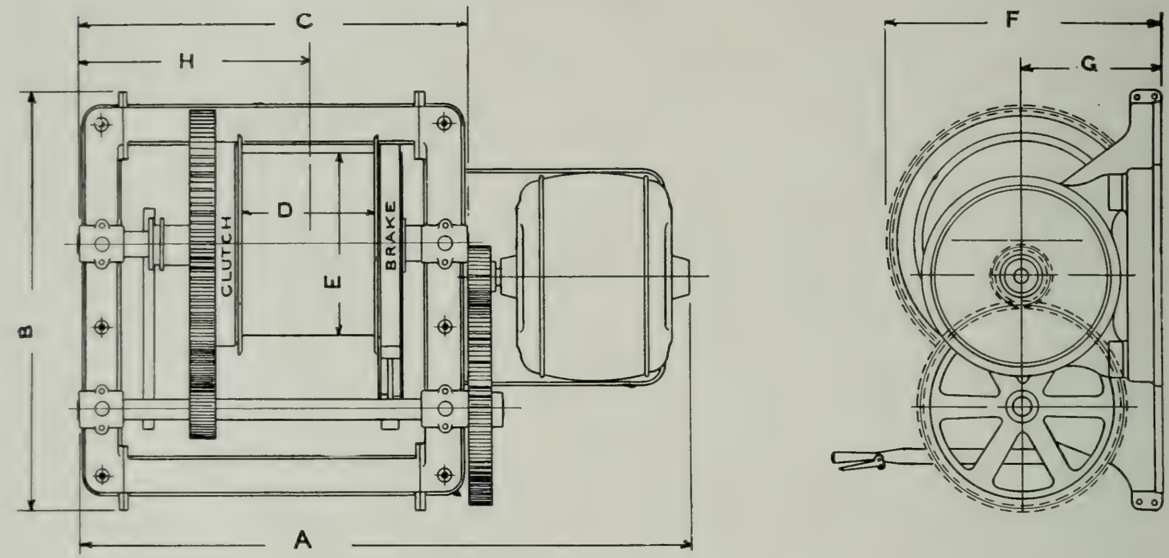

Maximum Rope Pull in Lbs.	Rope Speed in Ft. per Minute	Diam. of Rope	Feet of Rope in One Layer	DIMENSIONS							
				A	B	C	D	E	F	G	H
2000	250	½″	200	4′-8″	5′-9″	4′-3″	16″	24″	4′-3″	18″	2′-7″
2500	350	½″	260	8′-3″	5′-7″	4′-10″	18″	28″	3′-11″	22″	3′-0″
3500	400	⅝″	290	8′-6″	6′-6″	5′-6″	22″	32″	4′-2″	2′-2″	3′-3″
5000	500	¾″	410	11′-3″	7′-3″	6′-6″	28″	42″	5′-2″	2′-8″	3′-10″
7000	600	¾″	500	12′-3″	10′-1″	7′-7″	30″	48″	5′-10″	3′-0″	4′-9″

All dimensions are approximate only.

STANDARD DOUBLE DRUM ELECTRIC HOISTS

HIGH FRAME TYPE

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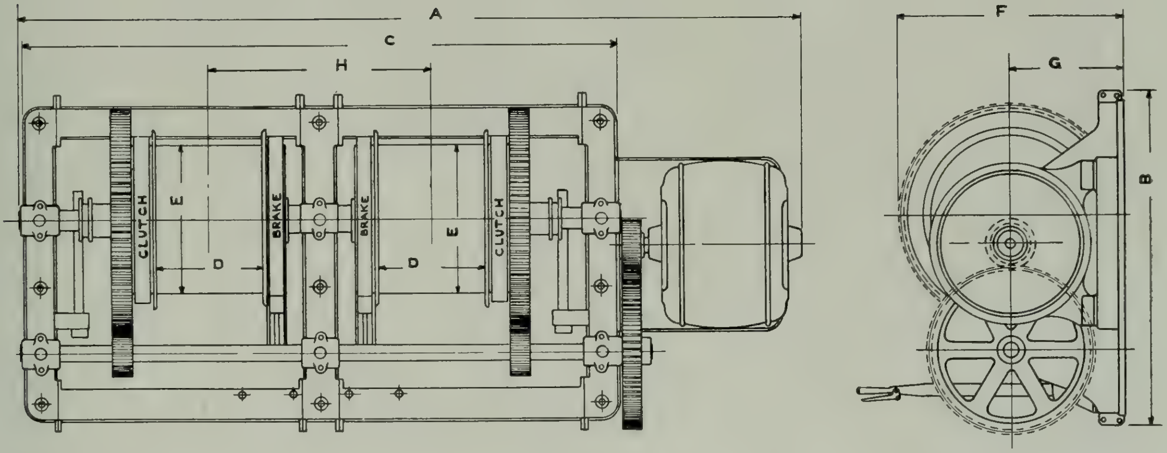

Maximum Rope Pull in Lbs.	Rope Speed in Ft. per Minute	Diam. of Rope	Feet of Rope in One Layer	DIMENSIONS							
				A	B	C	D	E	F	G	H
3500	400	⅝″	290	14′-4″	6′-6″	10′-6″	22″	32″	4′-2″	2′-2″	4′-0″
5000	500	¾″	410	17′-1″	7′-3″	12′-5″	28″	42″	5′-2″	2′-8″	4′-7″
7000	600	¾″	500	19′-5″	10′-1″	14′-5″	30″	48″	5′-10″	3′-0″	5′-0″

All dimensions are approximate only.

STANDARD SINGLE DRUM ELECTRIC HOISTS

LOW FRAME TYPE

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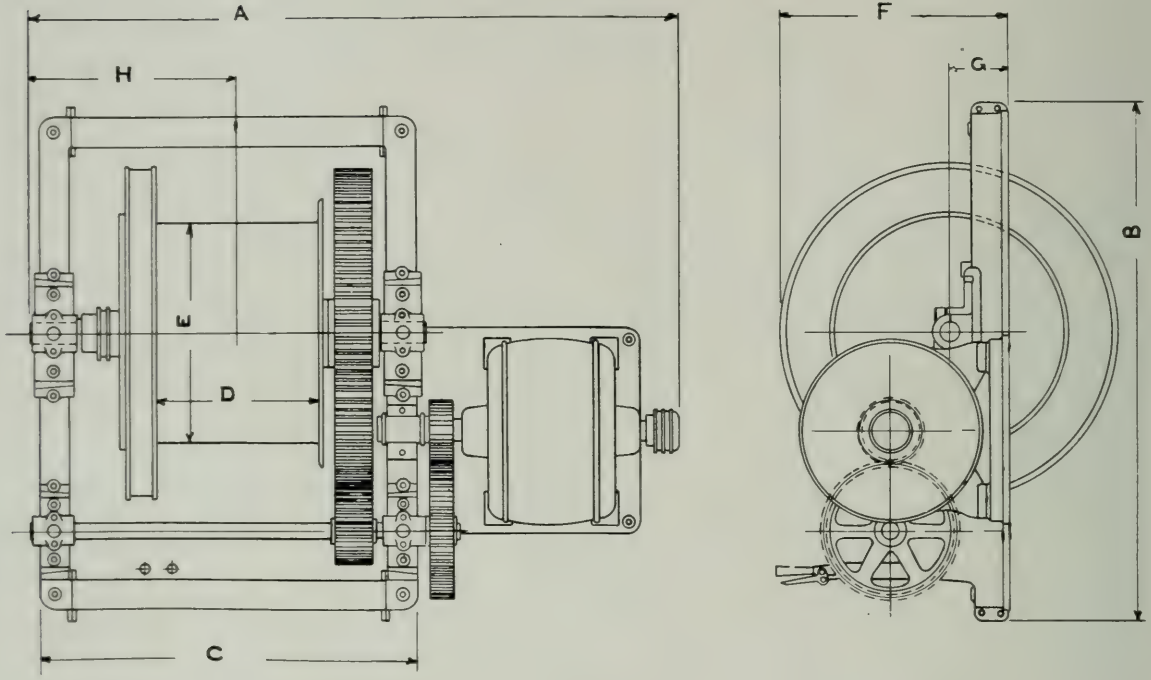


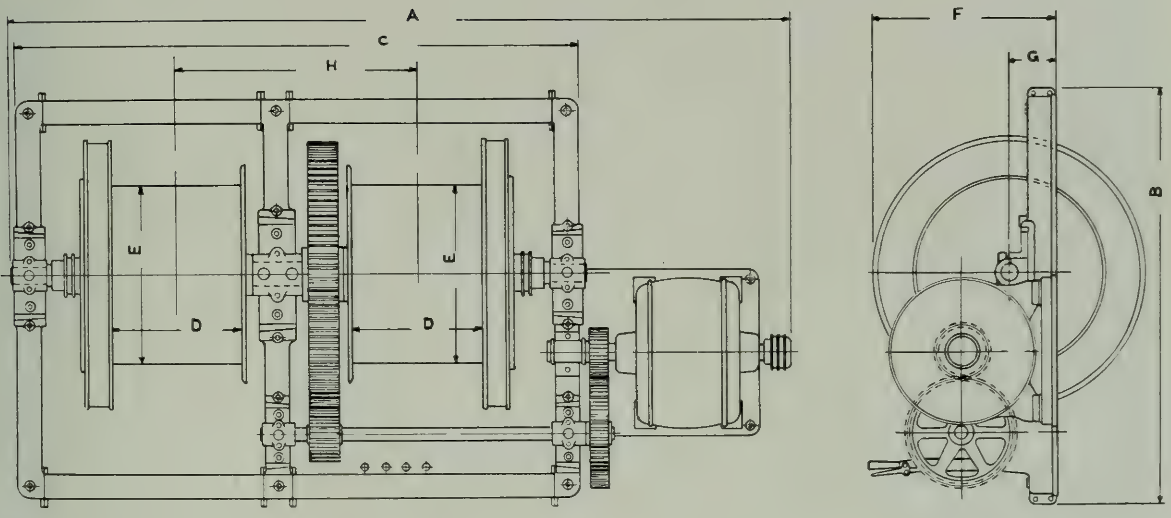
Maximum Rope Pull in Lbs.	Rope Speed in Ft. per Minute	Diam. of Rope	Feet of Rope in One Layer	DIMENSIONS							
				A	B	C	D	E	F	G	H
9000	700	7/8″	580	14′-4″	11′-9″	8′-0″	36″	54″	6′-0″	22″	4′-6″
12000	750	1″	630	16′-0″	14′-0″	9′-3″	40″	60″	6′-0″	24″	4′-9″
15000	750	1 1/8″	700	17′-3″	16′-0″	10′-3″	42″	72″	6′-3″	26″	5′-3″
20000	900	1 1/4″	775	19′-0″	18′-0″	12′-0″	48″	78″	6′-6″	27″	5′-6″

All dimensions are approximate only.

STANDARD DOUBLE DRUM ELECTRIC HOISTS

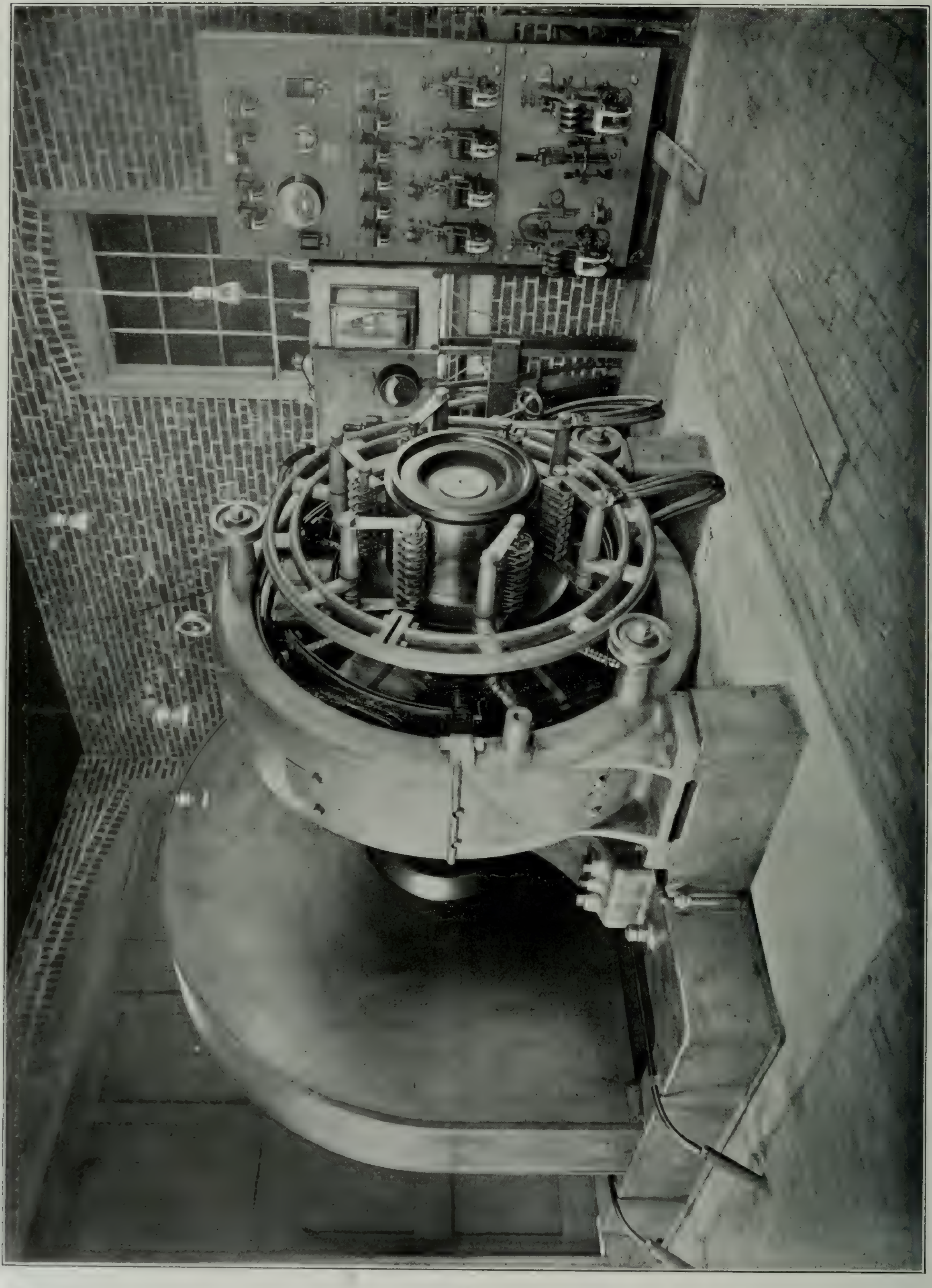
LOW FRAME TYPE

Cut No. 8216



Maximum Rope Pull in Lbs.	Rope Speed in Ft. per Minute	Diam. of Rope	Feet of Rope in One Layer	DIMENSIONS							
				A	B	C	D	E	F	G	H
9000	700	⅞″	580	20′-0″	11′-9″	14′-0″	36″	54″	6′-0″	22″	5′-7″
12000	750	1″	630	23′-0″	14′-0″	15′-9″	40″	60″	6′-0″	24″	6′-2″
15000	750	1⅛″	700	24′-0″	16′-0″	17′-6″	42″	72″	6′-3″	26″	6′-7″
20000	900	1¼″	775	26′-0″	18′-0″	19′-3″	48″	78″	6′-6″	27″	7′-3″

All dimensions are approximate only.



Cut No. 6934

Fly-Wheel Equalizing Generator Set with Fly-Wheel Encased. Starter and Automatic Speed Controller also Shown

LARGE HOISTS AND LOAD EQUALIZING SYSTEMS

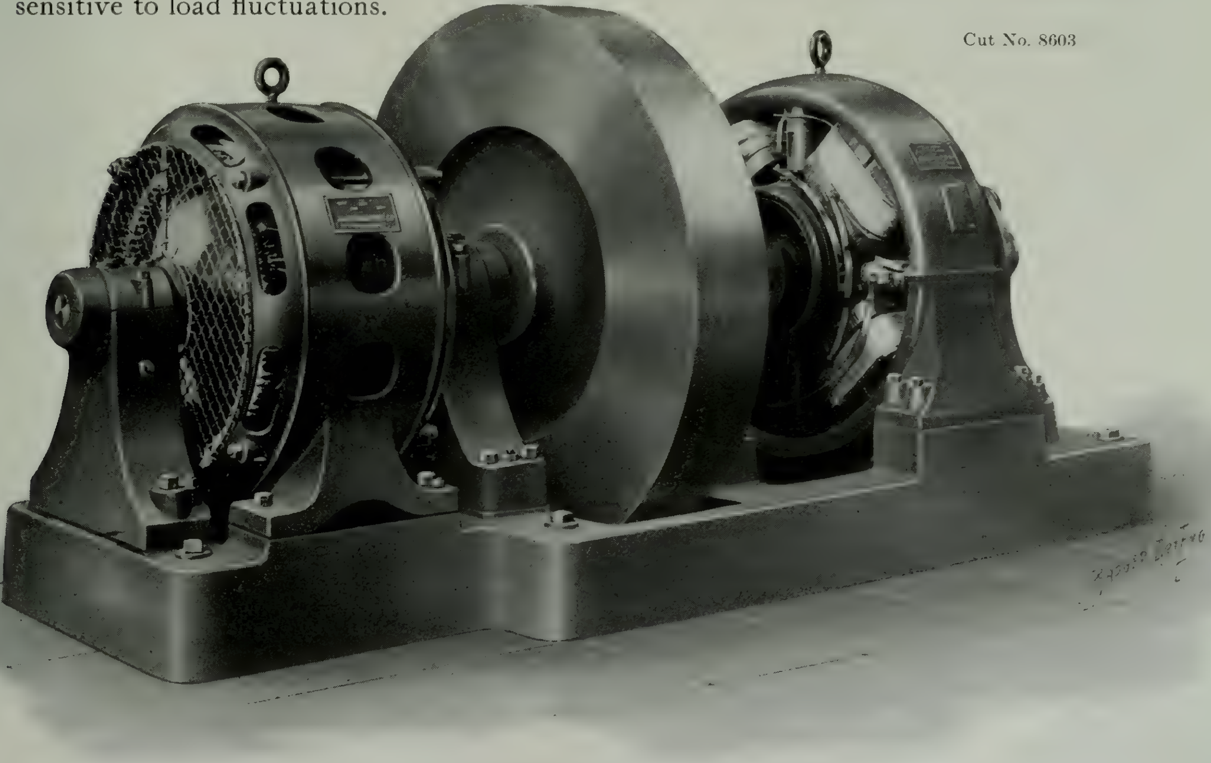
Generally induction motor drive for hoists can be successfully employed for shafts which are not too shallow and for installations in which the power station supplies a number of hoists in addition to supplying a large amount of power to other machinery, so that the disturbances on the line and station, due to starting the hoists, will be minimized and not affect other circuits fed by the same power station.

Large direct current motors have not been very widely used for hoisting purposes for the reason that the distribution is mainly alternating current in mining localities and if it is necessary to convert this current to direct current, there are systems which are more advantageous and economical than merely converting to direct current and controlling the hoist by means of resistance regulation of the armature current.

A large number of factors enter into the selection of the best suited system to hoisting for certain conditions, all of which must receive careful consideration before a selection is made in favor of any particular system. Among these factors are the load factor of the hoist, the nature of the load on the power station aside from hoisting, the capacity and kind of the existing or contemplated power station. If the power for driving the hoist is to be purchased from a power company, the basis of payment for this power must also receive consideration as to whether it is to be paid for on the basis of K. W. hours consumed, momentary peaks or limited time peaks.

In the case of large hoisting propositions the average power requirements over the hoisting cycle are generally small with large peaks at starting. These fluctuating conditions are a serious problem both to the power station, especially from the point of economy, and to the transmission line where the hoists are fed from a long transmission line which is very sensitive to load fluctuations.

Cut No. 8603



Motor-Generator Fly-Wheel Set

To equalize these widely varying loads and to reduce the demand on the power station to a practically constant value, various systems are employed. A motor generator set equipped with a suitable fly-wheel can be effectively used. In a locality where the distribution is alternating current, the set consists of a wound rotor induction motor coupled to a direct current shunt generator. The shaft of this set also carries the fly-wheel. A stater and automatic slip regulator is provided for the induction motor of the set by means of which the set is started and brought up to full speed. The hoist is equipped with a direct current shunt wound motor. The armature of the hoist motor is connected electrically direct to the armature of the generator. With a system of this kind the power input into the set is maintained practically constant, however great may be the load variations on the hoist motor. In order that the fly-wheel may deliver any of its stored energy, it is necessary to vary the speed of the set. This decrease in speed of the induction motor is limited for economical reasons to about 15 per cent, that is to 85 per cent, of normal full load speed of the motor. These speeds variations are accomplished by means of the automatic slip regulator which increases or decreases the resistance in the secondary circuit of the motor. When heavy overloads come on, due to starting the hoist, resistance is automatically inserted in the secondary circuit of the induction motor, thereby limiting the current taken from the line by the motor and at the same time allowing the speed of the set to fall somewhat. This enables the wheel to deliver some of its stored energy to the generator. On passing the overload period resistance is again automatically cut out of the rotor circuit, allowing the set to accelerate and come up to normal speed and restoring energy to the fly-wheel.

The speed of the hoist motor and direction of rotation is affected by varying and reversing the field current of the generator of the set thereby varying both the direction of current and the voltage impressed upon the terminals of the hoist motor.

The speed of a shunt wound direct current motor depends upon the voltage impressed upon its terminals and is practically not affected by the current strength in the armature, hence by the load on the motor, consequently the speed of hoisting depends only on the amount of excitation on the generator. The exciting current is only a very few per cent of the armature current and with this system it is therefore possible to operate at practically the same economy for all speeds of hoisting from a very slow speed for shaft inspection purposes to full maximum speed. In the case of resistance regulation the motor speed depends also on the load on the motor so that for any speed less than the maximum, part of the power consumed must be dissipated as heat in the resistance. With this latter type of control the power consumption and speed of hoisting will also depend on the skill of the operator which is not the case with the above system.

Electric hoists are used to a great extent for unloading large vessels at various docks. The source of current supply in many of these instances is direct current, generally purchased from some nearby Electric Light and Railway Company. A number of hoists are generally used at each dock and the operation of these impose heavy peaks of short duration on the power system. The average power requirements are low compared to the peaks. In order to reduce these load fluctuations in a case of this kind, Allis-Chalmers Manufacturing Company employs the use of a fly-wheel generator. This set consists merely of a suitable generator equipped with a fly-wheel. It is arranged to float on the line between the hoist and power house as a motor under normal conditions. As the overloads come on the hoist an automatic regulator decreases the speed of the set causing it to act as a generator and allowing the fly-wheel to deliver some of the stored energy to the generator and supply the additional power required above the average demand of the hoist. After the overload period is passed the regulator will act in the opposite way and cause the generator to accelerate to normal speed again.

These systems are designed to keep the peak loads and their disturbing influences off the line and to maintain a constant load on the power plant which is the most economical condition of operation.

HOISTING conditions vary so widely that the type of the hoist and the system must be laid out to meet the particular conditions in each case. Any hoisting problems submitted for consultation and advice as to the system best suited for the praticular requirements will be given prompt and careful attention. Allis-Chalmers Manufacturing Company will be pleased at any time to prepare specifications and submit prices on any type of hoisting plant when furnished with complete date and information regarding requirements. The service of this Company's engineers are at the disposal of those who require advice on any hoisting problem or installation. For information address Allis-Chalmers Manufacturing Company's nearest district office.

DATA FOR CALCULATING ROPE PULLS ON INCLINED PLANES

When hoisting on inclined planes, the inclination of the plane is usually expressed in mining work by the angle which the plane makes with the horizontal. Sometimes this inclination is expressed in percentage, meaning the relation of the rise of the incline to its length measured on the incline. This should not be confused with percentage as sometimes expressed in railway work, meaning in this case the relation between the rise of the incline to the length of its horizontal projection. In the former case the percentage would be equal to 100 times the sine of the angle and in the latter case to 100 times the tagent of the angle, therefore, for the former case a grade of 100 per cent. would be vertical, while if expressed according to the latter method would be an incline, making an angle of 65 degrees with the horizontal.

Below is given a table giving the actual rope pull on the rope in pounds per ton of 2000 pounds for angles of various inclinations. In one column is given the rise of the inclines per 100 feet measured along the incline as it would be measured in accordance with the first method described above and in another column is given the rise corresponding to the same angle for 100 feet measured on the horizontal projection.

In this table an allowance has been made for rolling friction and an additional allowance must be made for the hoisting rope.

Rise per 100 feet Measured on the Incline	Rise per 100 feet Horizontal	Angle of Inclination	**Stress in pounds per ton of 2000 Lbs.**
5	5.04	2° 53′	139.95
10	10.04	5° 44′	239.80
15	15.18	8° 38′	339.55
20	20.41	11° 32′	439.19
25	25.86	14° 30′	538.72
30	31.53	17° 30′	638.15
35	37.39	20° 30′	737.47
40	43.65	23° 35′	836.66
45	50.41	26° 45′	935.72
50	57.74	30° 0′	1034.64
55	68.38	33° 22′	1133.41
60	74.99	36° 52′	1232.00
65	85.56	40° 33′	1330.39
70	98.04	44° 26′	1428.56
75	113.36	48° 35′	1526.47
80	133.35	53° 8′	1624.00
85	161.28	58° 12′	1721.08
90	206.40	64° 9′	1817.44
95	304.15	71° 48′	1912.49
100	Infinite	90° 0′	2000.00

For any angle not given the stress of the rope can be calculated as follows:

Let S = the stress in lbs.

ϕ = angle the incline makes with the horizontal

Then $S = 2000$ sine ϕ plus 40 cos. ϕ

Allis-Chalmers Manufacturing Company's

PRINCIPAL PRODUCTS

AGRICULTURAL MACHINERY
Farm Tractors
Rotary Soil Tillers

AIR BRAKES

AIR COMPRESSORS
Steam Driven
Belt Driven
Electrically Driven, Portable
Electrically Driven, Stationary
Hydraulic Driven

CEMENT MACHINERY
Ball Mills
Ball Tube Mills
Balls, Forged
Crushing Rolls
Elevators
Feeders
Gyratory Breakers
Hoists
Mixing Pans
Perforated Metals
Revolving Screens
Rotary Coolers and Dryers
Rotary Kilns
Tube Mills
Tube Mill Linings
Tube Mill Pebbles

COAL MINING MACHINERY
Barney Cars
Crushing Rolls
Hoisting Cages
Revolving Screens
Shaking Screens
Ventilating Fans

CONDENSERS
Barometric
Jet
Surface

CRUSHING MACHINERY
Ballast Plants
Crushing Rolls
Dumping Skips
Elevators
Gyratory Breakers
Jaw Crushers
Macadam Plants
Perforated Metals
Portable Crushing Plants
Revolving Screens
Quarry Cars

ENGINES
Corliss Engines
Gas Engines
Diesel Oil Engines
Blowing Engines
Rolling Mill Engines

FORGINGS

PERFORATED METALS

FLOUR MILL MACHINERY
Aspirators
Bolters, Universal
Bolting Cloth
Bolting Cloth Cleaners
Bran and Shorts, Dusters
Bran Packers
Conveyors, Spiral
Corn Mills
Fans
Feed Mills
Feed Screens
Flour Dressers
Flaking Machines
Flour Feeders and Mixers
Flour Packers
Granulators
Purifiers
Reels
Rolls
Roller Mills
Rolling Screens
Scalpers

HOISTS
Electric Driven
Steam Driven

HYDRAULIC MACHINERY
Francis Turbines
Impulse Wheels
Oil Pressure Governors
Pressure Regulators
Accessories

MANGANESE BRONZE CASTINGS

MINING MACHINERY
Amalgam Appliances
Chilian Mills
Concentrating Plants
Conveyors
Copper Converting Plants
Cyanide Plants
Elevators
Frue Vanners
Gold and Silver Mills
Gyratory Breakers
Huntington Mills
Jaw Crushers
Jigs
Lead Refining Plants
Mine Ventilating Machinery
Mortar Mills
Ore Buckets
Ore Feeders
Prospecting Mills
Roasting Furnaces
Sampling Plants
Skips
Smelting Machinery
Stamps, Atmospheric
Stamps, Gravity
Stamps, Steam
Tube Mills, Wet and Dry

POWER TRANSMISSION MACHINERY
Belt Tighteners
Boxes
Couplings
Gears
Hangers
Pulleys
Rope Sheaves
Shafting

PUMPING MACHINERY
Centrifugal Pumps
Fire Service Pumps
Geared Pumps
"High Duty" Pumping Engines
Hydraulic Transmission Pumps
Screw Pumps

ROLLING MILL MACHINERY

SAW MILL MACHINERY
Band Mills, Double Cutting
Band Mills, Single Cutting
Band Mills, Telescopic
Band Re-saws, Horizontal
Band Re-saws, Vertical
Board Lifters, Steam
Cant Flippers, Steam
Canting Machine, Overhead
Carriages
Circular Saw Mills
Conveying Machinery
Cutting Off Saws, Steam Feed
Edgers
Edging Grinders
Feeds, Steam, Direct Acting
Feeds, Steam, Twin Engine
Filing Room Tools
Lath Mills and Bolters
Live Rolls and Drives
Log Chains
Log Jacks
Log Loaders
Log Turners
Niggers, Steam
Set Works
Slashers
Steam Feed Valves
Stock Lifters, Steam
Transfers
Trimmers

SUGAR MACHINERY

TIMBER TREATING AND PRESERVING MACHINERY

TURBINES—STEAM

TURBINES—WATER

ELECTRICAL APPARATUS

ALTERNATING CURRENT GENERATORS AND MOTORS
Belted Type Generators
Engine Type Generators
Fly-wheel Type Generators
Turbo Generators
Water-wheel Type Generators
Synchronous Frequency Changers
Induction Motor Frequency Changers
Synchronous Motor-Generator Sets
Induction Motor-Generator Sets
Synchronous Motors
Synchronous Condensers
Induction Motors
Transformers
Rotary Converters

DIRECT CURRENT GENERATORS AND MOTORS
Belted Type Generators
Engine Type Generators
Small Bipolar and Multipolar Motors and Generators
Electric Railway Equipments, Motors, Controllers, etc.
Multiple Voltage Balancing Sets
Multiple Voltage Variable Speed Equipments

SWITCHBOARDS FOR DIRECT CURRENT AND ALTERNATING CURRENT

Allis-Chalmers Manufacturing Company

General Offices, . . Milwaukee, Wis., U. S. A.

DISTRICT OFFICES

Atlanta, Ga., 1104 Healey Bldg.
Boston, Mass., 50 Congress St.
Buffalo, N. Y., Ellicott Square Bldg.
Chicago, Ill., Peoples Gas Bldg.
Cincinnati, O., First National Bank Bldg.
Cleveland, O., Schofield Bldg.
Dallas, Texas, Sumpter Bldg.
Denver, Colo., First National Bank Bldg.
Detroit, Mich., Ford Bldg.
Duluth, Minn., Alworth Bldg.
El Paso, Texas, 2900 San Diego St.
Indianapolis, Ind., 516 Traction Terminal Bldg.
Kansas City, Mo., Waldheim Bldg.
Los Angeles, Cal., Title Insurance Bldg.
Milwaukee, Wis., West Allis Works
Minneapolis, Minn., Corn Exchange Bldg.
New Orleans, La., Maison Blanche, Bldg.
New York, N. Y., 50 Church Street
Philadelphia, Pa., 903 Pennsylvania Bldg.
Pittsburgh, Pa., 1209 Park Bldg.
Portland, Ore., 92 First St.
St. Louis, Mo., Railway Exchange Bldg.
Salt Lake City, Utah, Kearns Bldg.
San Francisco, Cal., Rialto Bldg.
Seattle, Wash., 115 Jackson Street
Toledo, O., Ohio Bldg.

FOREIGN DISTRICT OFFICES

London, England, 732 Salisbury House, London Wall, E. C.
Santiago, Chile, Huerfanos 1157, Casilla 2653.

CANADIAN REPRESENTATIVES

Canadian Allis-Chalmers, Limited: Toronto, Ont.

FOREIGN SALES AGENCIES

Auckland, New Zealand,	John Chambers & Sons, Ltd.
Bombay, India,	Marshall Sons & Co.
Buenos Aires, Argentine Republic,	American Trading Company
Calcutta, India,	Marshall Sons & Co.
Honolulu, Hawaii,	Honolulu Iron Works
Ipoh, Federated Malay States,	McAlister & Co., Ltd.
Johannesburg, South Africa,	Herbert Ainsworth
Kobe, Japan,	American Trading Company
Manila, Philippine Islands,	American Trading Company
Paris, France,	R. Sequin
Perth, West Australia,	Frank R. Perrot
Rio de Janeiro, Brazil,	American Trading Company
Petrograd, Russia,	International Engineering & Trading Co.
Shanghai, China,	American Trading Company
Singapore, Straits Settlements,	McAlister & Co., Ltd.
Sydney, Australia,	Frank R. Perrot
Sydney, Australia,	Standard-Waygood, Ltd.
Yokohama, Japan,	American Trading Company